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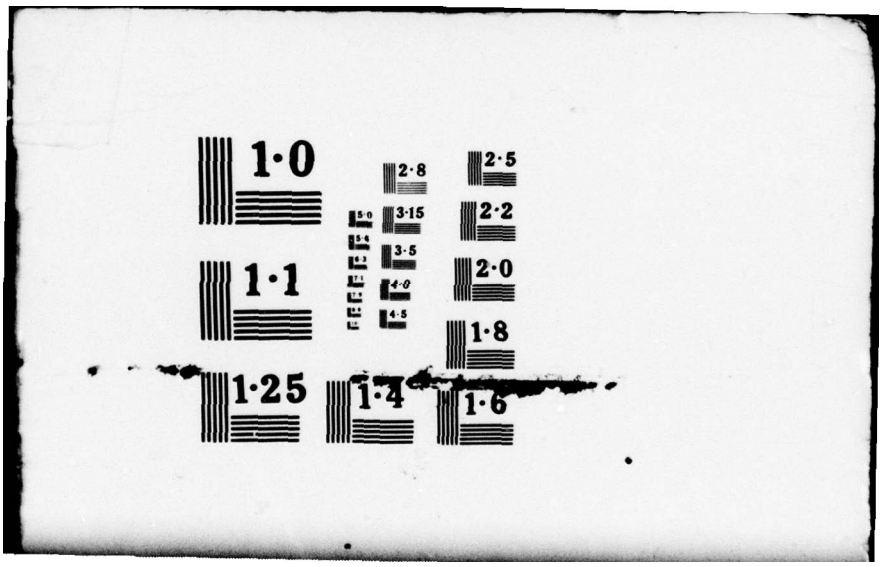
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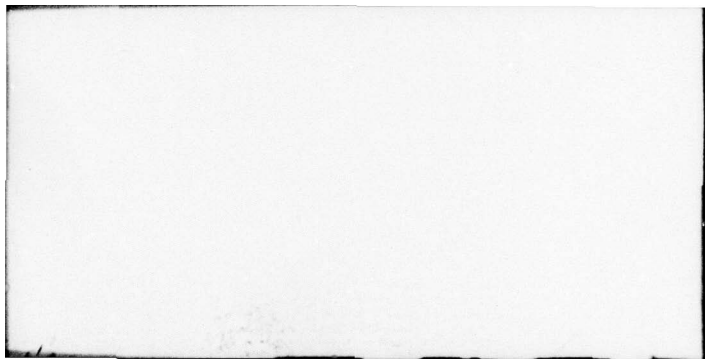

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ELECTRICAL ENGINEERING DIGITAL DESIGN LABORATORY COMMUNICATIONS NETWORK (Part 3 of 3)

THESIS

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Captain USAF

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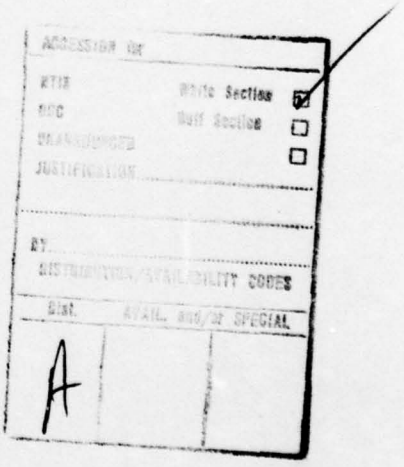

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PART 3

Altair 8800b/CYBER 74 Interface

Program User's Manual

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1.0 INTRODUCTION

This manual provides instructions on how to operate the CYBER System Computer Program (CYBERSCP). The primary purpose of the CYBERSCP is to provide a software interface that allows direct transfer of user created data files between the Altair 8800b minicomputer and the ASD/AFIT CDC CYBER 74 computer. The CYBERSCP also provides the capability to execute SCOPE commands using the CYBER 74 INTERCOM System (5). The CYBERSCP is composed of five computer programs implemented on the Altair 8800b computer in the Electrical Engineering Digital Engineering Laboratory. The five programs are: (1) DOSCYB, (2) CYBER, (3) CIN3, (4) BASIC and (5) TIME. All of these programs working together establish and maintain the CYBER 74 to Altair data interface. Instructions for initialization and operation of these programs is in Section 1.4.

This user's manual includes procedures for equipment configuration, software initialization, software operation and hardware and software termination. In addition, specific hardware and software limitations are described. These limitations include both operational constraints and BASIC programming constraints imposed by the CYBERSCP.

1.1 Scope. This manual is intended to be used by persons familiar with the North Star MICRO DISK SYSTEM (3) and North Star BASIC (4). Since the programs that compose the CYBERSCP are constructed based on the North Star system

programs, all of the operational procedures in the North Star System are applicable in the CYBERSCP. This manual, therefore, describes only the detailed operational procedures for using the CYBERSCP and specific limitations of the hardware and software added to the CYBERSCP. This manual will provide sufficient information to operate the additional procedures in the CYBERSCP. It will also describe the limitations imposed by the addition capabilities of the CYBERSCP. This manual describes all user output messages, commands and error messages. A detailed discussion of the theory of operation of the software programs composing the CYBERSCP is found in reference 7.

1.2 Manual Organization. The user's manual is designed to provide the user with a concise set of operational procedures for operating the CYBERSCP hardware and software. To do this, the manual briefly describes the hardware and software configurations in Sections 1.3 and 1.4 respectively. The scope of the document is provided in Section 1.1. The operational procedures are explained in Section 2.0 and are divided into hardware initialization/operation, Section 2.1, and software operation, Section 2.2. Section 3 describes all of the commands available to the user by functional groups. The limitations of both the hardware and software are described in Section 4. The system output messages are divided into normal messages and error messages. These messages are described in Section 5.0. Section 6.0 contains

a brief description of the initialization parameters for the CYBERSCP data base.

1.3 Hardware Configuration. The minimum hardware required for the CYBERSCP system is summarized in Table 1.1. The hardware listed is required for proper operation of the system. Hardware described in Table 1.1 should be interconnected according to Table 2.1.

1.4 Software Configuration. The CYBERSCP consists of five programs (DOSCYB, CYBER, CIN 3, BASIC, TIME) and one data file (DATA). These programs and data file must be loaded and initialized for the system to function. The software and data files reside on both the disk and in PROM. Table 1.2 briefly describe the programs' functions, source device, location in memory and type of code used in each program. Proper configuration of the software system consists of ensuring that the disk and PROMS containing the software listed in Table 1.2 are present when the system is initialized. Software initialization is explained in Section 2.0.

**********NOTE**********
The equipment listed in Table 1.1 is recommended. However any functionally equivelant hardware may be substituted for the appropriate devices. If different I/O Boards are used, be sure that the port assignments and status information bits generated by the boards are compatable with the existing I/O driver software.
**********NOTE**********

TABLE 1.1

ITEM	DESCRIPTION/COMMENT
Altair 8800b Computer	Mainframe, Back plane and CPU
88-2SIO Serial Interface Board	Configured ports 16, 17, 18, 19
88-4PIO Parallel Interface Board	Configured with ports 34 and 35
32K Random Access Memory	Contiguos address starting at 000
88-PMC PROM card	Contiguos address starting at 62K
88-VI/RTC Vector Interupt Board	Set for internal clock with 10 msec time interval
MDS Mini Floppy Disk and Controller Board	Primary disk unit for CYBERSCP
ADM-3A Interactive Display* Terminal (or equivalent)	Primary Operator interface device. Assign to port 16, 17 at 9600 baud
Centronix C-100 printer (or equivalent)	Provides hard copy. Assign to ports 34 and 35.
Anderson-Jacobson Modem**	Provides coupling between telephone and Altair 8800b. Assign to ports 18 and 19 at 300 baud.
+5, +12 VDC Power Supply for mini-floppy unit	Provides power for the disk unit. The controller board uses Altair power.
SA-400 Hard Sector Disk with the label "CYBERSCP"	Contains all CYBERSCP software programs and data files

*Texas Instrument silent 700 may be substituted. Reconfigure 88-SIO board for correct baud rate.

Hardware Configuration List (1 of 2)

Table 1.1 (Cont'd)

**If any commands requiring a CYBER 74 Computer response are attempted with the modem off or the CYBER 74 is not connected, the CYBERSCP will stay in the monitor mode. The system must be reinitialized to continue.

Hardware Configuration List (2 of 2)

TABLE 1.2

Program Name	Source Device	Address	Description
DOSCYB	CYBERSCP diskette	2000-29FF	8080 machine coded operating system main routine
CYBER	CYBERSCP diskette		Basic scource code program that provides the user command interface
CIN3	PROM (FB00-FDFF)	FB00-FDFF	8080 machine language Input/Output subroutines for DOSCYB
BASIC	CYBERSCP diskette	2A00	8080 machine language BASIC Interpreter
DATA	CYBERSCP diskette	0-1FFF	Common data file for DOSCYB, CIN3, TIME and CYBER. Contains initial values for all parameters
TIME	PROM (FE00-FFFF)	FE00-FFFF	Time-of-day and event counters.

Software Configuration List

TABLE 2.1

FROM	TO	VIA
ADM-3A CRT	Altair Rear Panel Plug "Port Ø"	"ADM-3A" std. RS-232 cable.
Anderson-Jacobson Modem	Altair Rear Panel Plug "PORT 1"	"CYBER 74/ALTAIR" RS-232 CABLE (This cable is not compatible w/ ADM-3A)
Centronics C100 Line printer	Altair Rear Panel Plug "PRINTER"	"PRINTER" non-RS-232 cable
Schugart Disk Drive	Altair Rear Panel Plug "DISKETTE"	26-Pin flat cable
Schugart Disk Drive	+12 Vdc Power Supply	Schagart +12V cable
Schugart Disk Drive	+5 Vdc Power Supply	Schugart +5V cable

CYBERSCP Hardware Connections

2.0 OPERATION

This section describes the procedures required to operate the CYBERSCP. These procedures include both hardware and software instructions. The user should be familiar with the Altair 8800b computer operating characteristics and operating procedures. Familiarization with the Schugart mini-floppy disc system hardware and disc handling procedures is also required (2). In addition, familiarization with the North Star DOS Operating System (3) and the North Star BASIC language (4) is required. Familiarization with the latter two manuals, DOS and BASIC, is required since the CYBERSCP system was constructed using DOS and BASIC as a starting foundation. All of the commands and operating characteristics of DOS and BASIC are applicable to the CYBERSCP.

2.1 Hardware Initialization. The following procedures describe the CYBERSCP hardware configuration and initialization procedures: (The procedures are summarized in Figure 2-1).

1. Configure the Altair 8800b computer system in Table 1.1 according to Table 2.1

2. Select 9600 baud rate for Port 0 on the 88-2SIO Board by positioning jumper wire CK0 to 9600 on the board. (This will be the ADM-3A CRT port)

3. Select the 300 baud rate for Port 1 on the 88-2SIO Board by positioning jumber CK1 to 300.

4. Attach the "write protect" tab on the CYBERSCP mini-floppy diskette. (If the SA command is used, remove the tab prior to executing the command).

**********CAUTION**********
Diskette contents can be overwritten if the "write protect" tab is removed. Caution must be exercised when using an unprotected diskette.
**********CAUTION**********

5. Insert the CYBERSCP diskette into the Schugart disk drive unit.

6. Turn power ON to the disk unit.

7. Turn the Altair 8800b POWER switch to ON.

8. Turn the ADM-3 CRT ON. Wait for the cursor to appear in the upper left corner of the screen.

9. Press the Altair 8800b RUN/STOP switch to STOP.

This completes the hardware initialization procedures. In the event of a failure during any step above and the diskette is "write protected", go back to Step 1 and reinitialize the system. If the failure persists, consult the appropriate hardware reference manual.

**********WARNING**********
If the diskette is NOT "write protected" and a failure occurs, STOP. Determine the cause of the failure before proceeding. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE DISKETTE CONTENTS.
**********WARNING**********

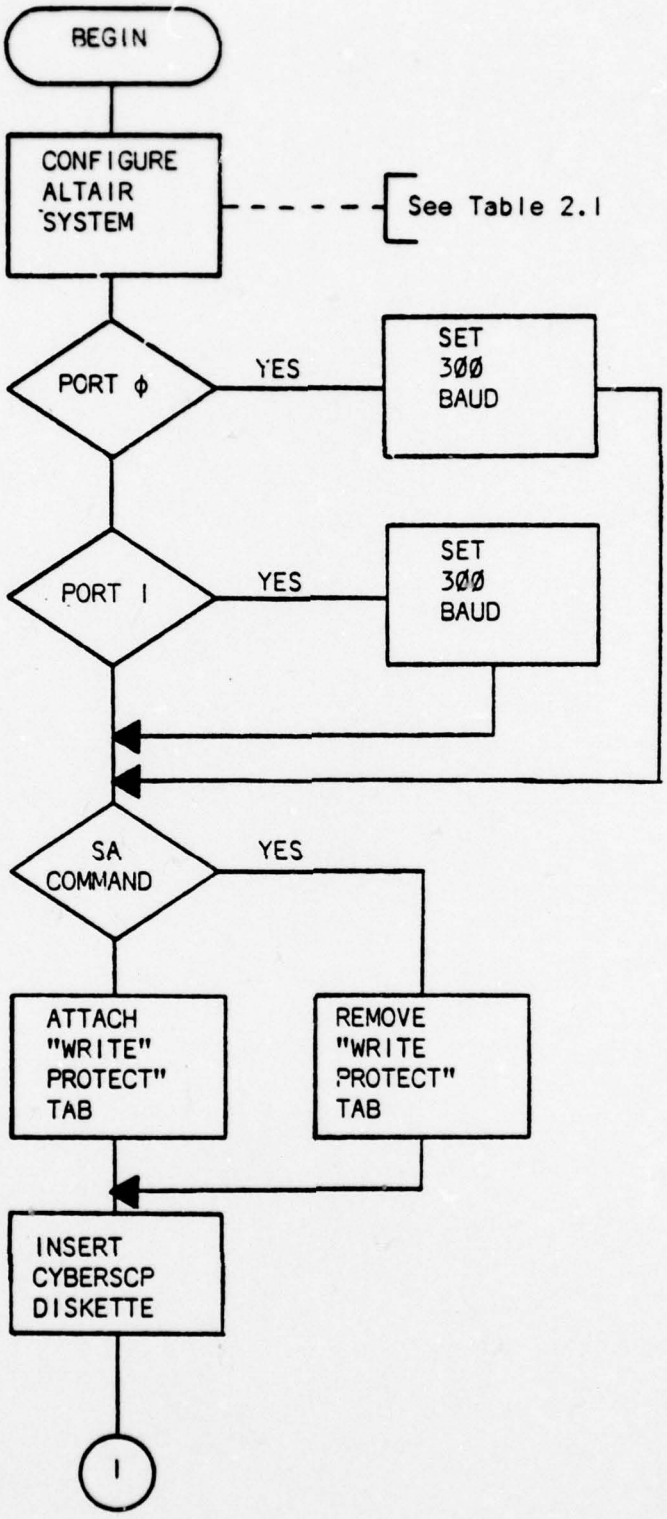

Figure 2-1 Hardware Initialization Procedures (1 of 2)

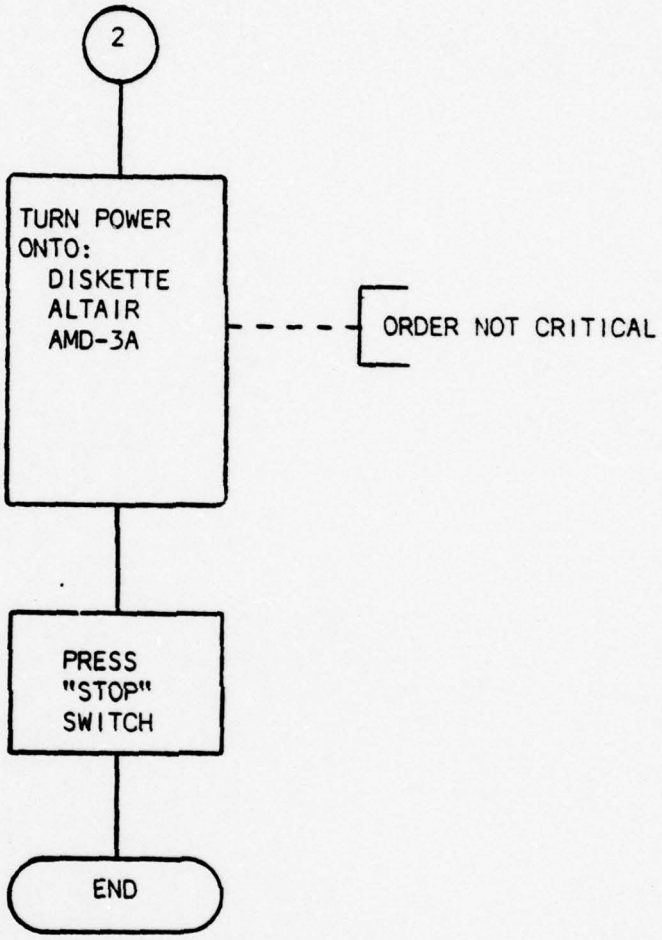

Figure 2-1 Hardware Initialization Procedures (2 of 2)

2.2 Software Initialization. The following procedures describe the initialization and standard operation of the CYBERSCP system. The procedures explain how to initialize the system software programs DOSCYB, BASIC, CYBER, and TIME. The procedures then describe how to operate these programs once they are initialized.

In the following paragraphs, operator instruction sequences are described. Capitalized words are mandatory operator entries from either the key board or Altair front panel. Items in angle brackets, < >, are specific keyboard entries (For example: <CR> is a carriage return). CONTROL/x is a special keyboard entry generated by simultaneously pressing the "CONTROL" and "x" keys on the keyboard, where "x" is any key. (Example: CONTROL/C). An extensive example of the software initialization procedure is described in Appendix 3-1.

2.2.1 DOSCYB Initialization. Once the hardware is initialized and the Altair computer system has been successfully powered (see Section 2.1 for hardware initialization), the following procedures (see Figure 2-2) should be followed to initialize the DOSCYB system program (all referenced switches are on the Altair front panel):

1. Select address E900(HEX) on the Altair 8800b front panel (switches A15-A13, A11, A8 up; A12, A10, A9, A7-A0 down).

2. Press RESET switch on the front panel to RESET.

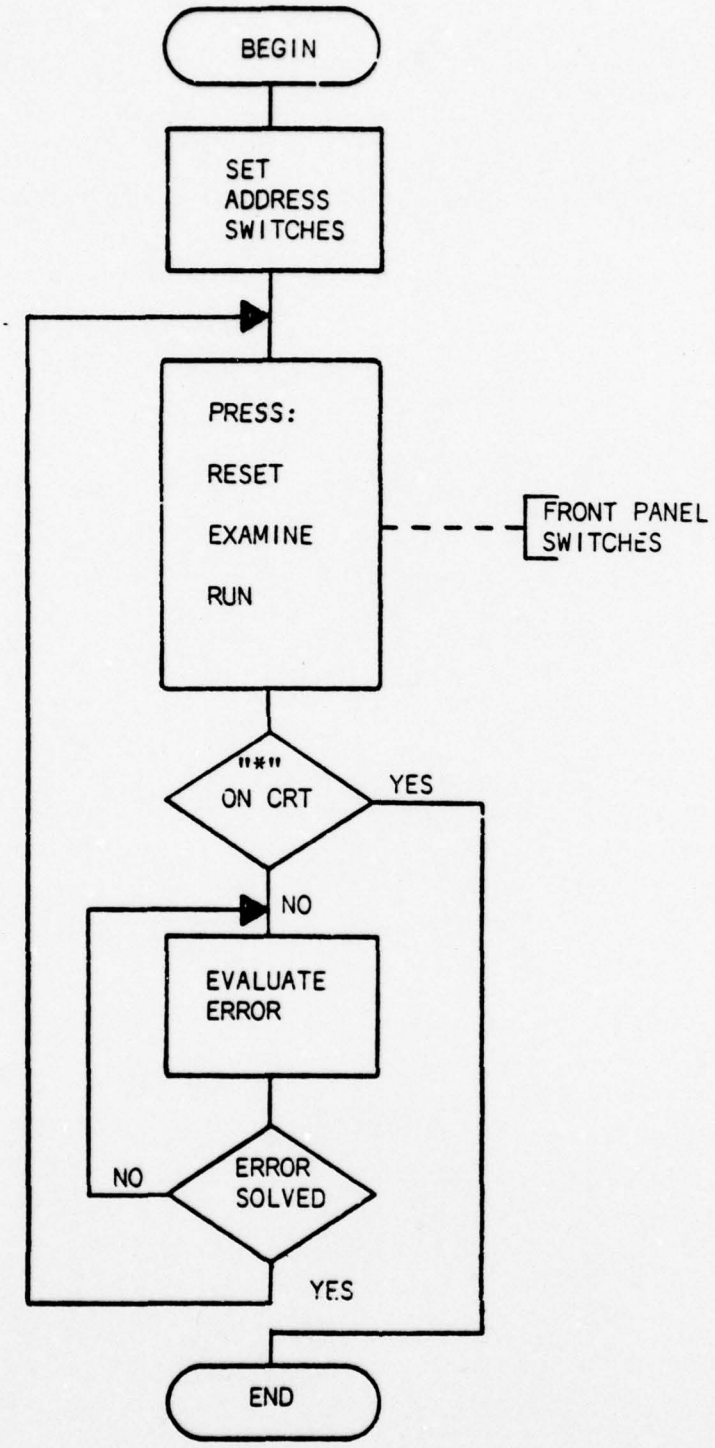

Figure 2-2 DOSCYB Initialization Flowchart

3. Press EXAMINE/EX NEXT switch to EXAMINE. (Address E900 should be present on the address indicator LEDs and 31(HEX) should be displayed on DATA indicator LEDs).

4. Press the RUN/STOP switch to RUN. (The disk drive should turn on and an asterisk, "*", should be output to the CRT).

The DOSCYB program is now running. No further initialization is required by the operator to exercise all of the DOSCYB commands in Section 3.1. The following actions should automatically take place as soon as the RUN/STOP switch is switched to RUN:

1. DOSCYB program is read from the diskette into memory at location 2000(HEX) and executed.

2. DOSCYB then reads in the disk file DATA which initializes the data base parameters in Table 6.1.

3. DOSCYB is automatically linked to the CIN3 subroutine in PROM, located at FB00(HEX) to FDFF.

**********WARNING**********
Failure during any software initialization while using an
unprotected diskette (no "write protect" tab on diskette)
can result in permanent damage to the diskette contents.
All failures should be thoroughly analyzed before any
further action is taken.
**********WARNING**********

2.2.2 BASIC Initialization. The DOSCYB program must be initiated and running prior to initializing the BASIC program. Perform the following steps to initialize BASIC (see Figure 2-3):

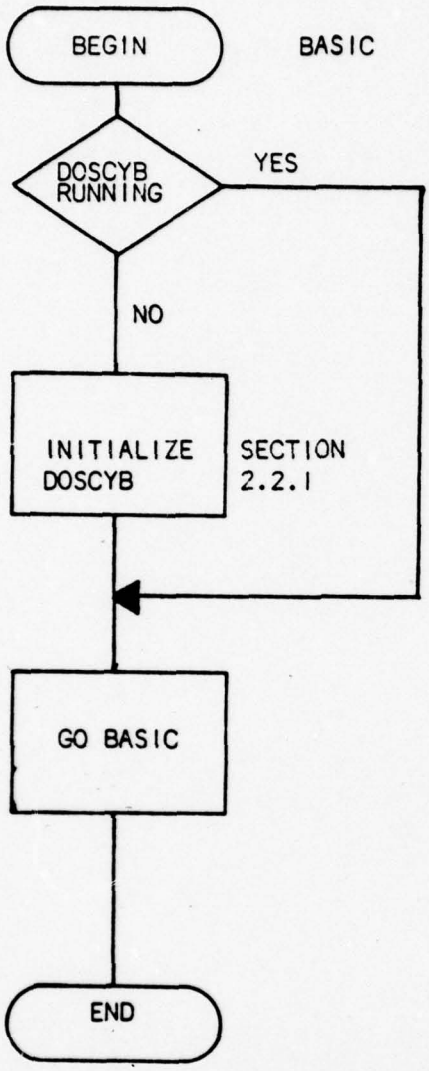

Figure 2-3 BASIC Initialization Flowchart

1. Initialize the BASIC program if not running. (See Section 2.2.2)

2. Enter: LOAD CYBER <CR> (BASIC will respond READY).

BASIC is now initialized and all BASIC commands described in Section 3.2 may be executed.

2.2.3 CYBER Program Initialization. The CYBER computer program is written in BASIC source code and is stored on the mini-floppy diskette labelled CYBERSCP. It contains the software required to interpret and execute the CYBER program commands described in Section 3.3. Since it is written in BASIC source code, the BASIC program must be initialized prior to executing CYBER. The procedures for initializing the CYBER program are (see Figure 2-4):

1. Initialize the BASIC program if not running. (See Section 2.2.2).

2. Enter: LOAD CYBER <CR> (BASIC will respond: READY).

3. ENTER: RUN <CR> (CYBER program will respond: REQUEST-).

The CYBER program is now running. All CYBER program commands described in Section 3.3 may be executed.

2.2.4 TIME Initialization. The TIME program is written in 8080 machine language and is stored in PROM locations 7E06(HEX) to 7EFF. The TIME program services the interrupt generated by the Vector/RTC circuit board (see Table 1.1). Each time TIME services the interrupt, it increments the

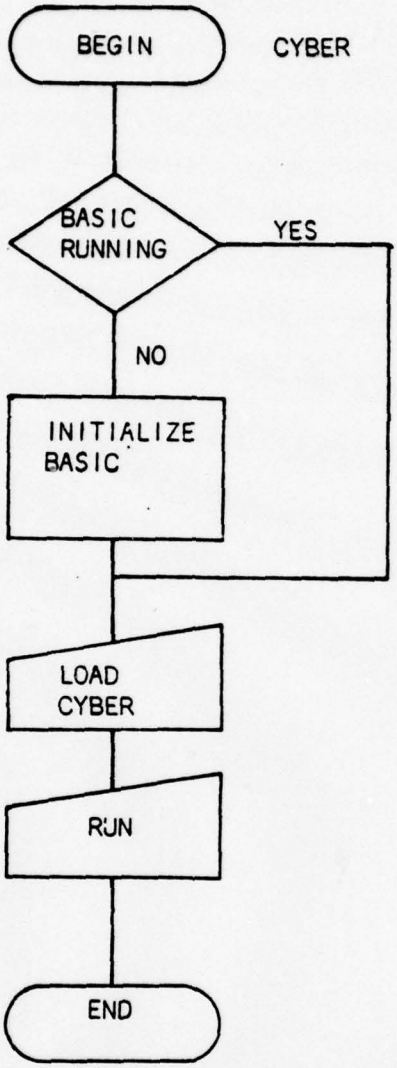

Figure 2-4 CYBER Initialization Flowchart

the time-of-day counter. In this manner, TIME continually monitors system time. Since it is stored in PROM, the program is automatically initialized when the Altair 8800b is powered up. Since the program is interrupt driven by the Vector/RTC board it will not begin execution until the 8080 interrupt system has been enabled and the Vector Interrupt board (Table 1.1) has been initialized. When the DOSCYB program is initialized, it automatically enables the 8080 interrupt system. The Vector Interrupt card is initialized by sending the proper control sequences to the card (See the Vector Interrupt Card Manual (6:3-7)). The initialization sequence is executed by calling the 8080 machine language subroutine stored at locations 7E00 to 7E05 in PROM. This call is executed automatically when the CYBER program is initialized. Once the TIME program begins execution, it will continue to execute everytime an interrupt from the Vector/RTC board is generated. To stop the execution of the TIME program the Altair 8800b must be RESET or the Vector Interrupt/RTC board must be turned off (6:6).

2.2.5 Data Link Initialization. This section completes the software initialization sequence for the CYBERSCP system. Before the Altair computer can transfer data to and from the CYBER 74 computer system, the two computers must be linked together via data lines. These data lines are provided via 300 baud telephone lines and RS-232C compatible modems. The modems provide the digital analog conversion

between the computers. The following procedures describe how to establish this communications link (see Figure 2-5):

**********NOTE**********
These procedures may be executed any time after DOSCYB initialization (Section 2.2.1). These procedures must be executed prior to attempting any CYBER commands requiring the CYBER 74 computer (TR, SA, CY commands).
**********NOTE**********

1. Enter: CONTROL/T (DOSCYB will respond: TELE MODE).
2. Turn the modem ON.
3. Dial the appropriate 300 baud CYBER 74 Computer Center telephone number.
4. Wait for steady tone (carrier present tone) then place the handset in the modem cradle. (CARRIER light on modem will light).
5. LOGIN on Intercom using standard Intercom Protocol (5).

This completes the CYBER 74 computer to Altair computer data link initialization. The Altair may now communicate with the CYBER 74 system using the commands described in Section 3.0.

2.3 Altair System Turn Off. To power the CYBERSCP hardware system down, follow the following procedures:

1. Turn power to the diskette OFF.

**********WARNING**********
DO NOT turn power OFF while the diskette head is engaged (red indicator light ON). Doing so may damage the diskette information.
**********WARNING**********

2. Turn the Altair 8800b POWER switch to OFF.

3. Turn the ADM-3A CRT OFF.

4. Turn the modem OFF.

5. Return the telephone handset to the phone cradle.

6. Remove the diskette.

7. Turn the line printer OFF.

2.4 Procedure Summary. This section provides concise procedures to perform command sequences categorized by function. The system responses are listed after each input.

2.4.1 CYBERSCP Power Up.

1. Configure system according to Table 3.1.

2. Turn power ON to Altair 8800b, Schugart disk unit, and ADM-3A CRT.

3. Press: RUN/STOP switch to STOP.

2.4.2 DOSCYB, BASIC, CYBER, TIME Initialization.

1. Power-up CYBERSCP.

2. Press: RESET on Altair

3. Select address E900(HEX)

4. Press: EXAMINE/EX NEXT to EXAMINE

(DOSCYB response: *).

5. Press: RUN/STOP to RUN

6. Enter: GO BASIC <CR> .

(BASIC response: READY)

7. Enter: LOAD CYBER<CR> .

(BASIC response: READY)

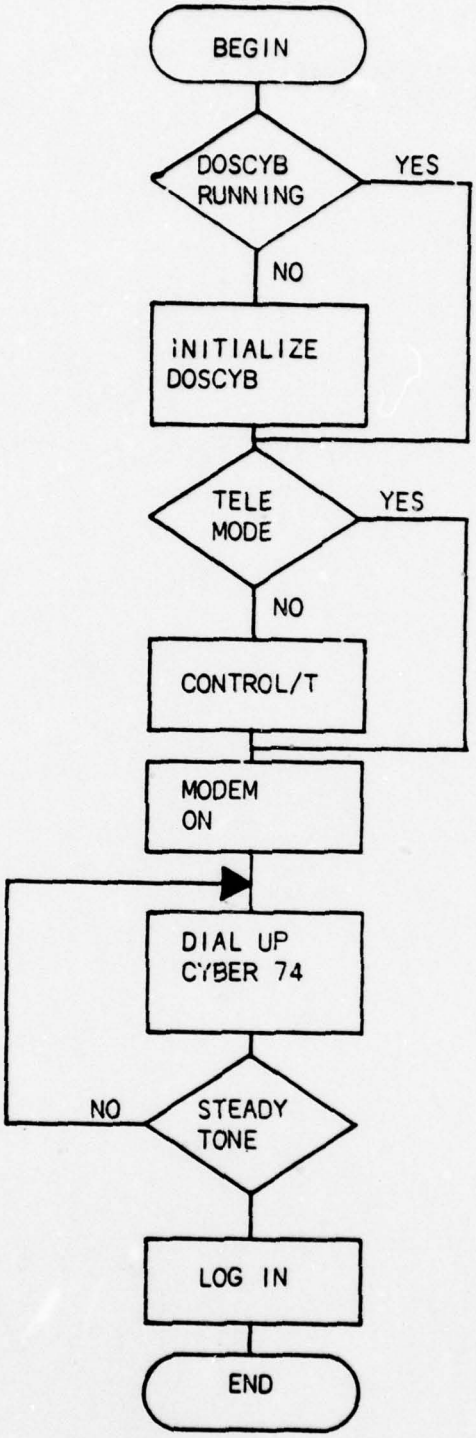

Figure 2-5 CYBER 74 Data Link Initialization

8. Enter: RUN <CR> .

(CYBER response: REQUEST-).

3.0 COMMANDS

This section describes the commands available to the user of the CYBERSCP system. The commands are divided into three categories: (1) DOSCYB commands, (2) BASIC commands, and (3) CYBER program commands. Each command is described in the following sections by first describing the command's syntax folled by a functional description of the command. The following symbols are used to describe the commands' syntax:

< >	contains mandatory information that must be supplied by the user
[ ]	contains information that is optional
<source>	user must supply a valid file name which will be used as the source file.
<device>	user must supply a valid device code from the following list:

CODE*	DESCRIPTION
0	CRT (Ports 16, 17) Command Console
1	Auxiliary CRT (Ports 20, 21)
2	CYBER 74 (Ports 18, 19)
3	PRINTER (ports 34, 35)
4	Auxiliary CRT (Ports 22, 23)
5,6,7	NOT ASSIGNED

<LF> Line feed

<blank>	ASCII space character, 040(OCTAL).
<CR>	carriage return.
CONTROL/x	user entered sequence typed by holding down the control key simultaneously with the character x, where x is any keyboard character,
,	comma is the only delimiter allowed between command parameters.

All capitalized words must be entered by the operator. Also all commands except CONTROL/x commands must be terminated by a carriage return (RETURN key on ADM-3A).

*NOTE - North Star DOS allows only codes 0-7. See Section 3.2.3 for a description of the input/output control.

3.1 DOSCYB Commands. The DOSCYB program is the system executive for the CYBERSCP. It therefore controls the execution of all other programs including BASIC and CYBER. The DOSCYB program has two modes of operation. The first mode is the direct mode in which the user communicates directly with the DOSCYB using the commands described in the North Star Disk Operating System Manual (3:5-7). In this mode DOSCYB responds with an asterisk, *, after each command (3:5). The second mode of operation is the program mode. This mode is entered whenever the DOSCYB program is executing the BASIC program. In this mode only the following commands are allowed:

CONTROL/T causes DOSCYB to immediately switch from the DATA to TELE mode or TELE to DATA mode. When in the DATA mode the user can communicate with the DOSCYB operating system. When in the TELE mode, the user is in direct contact with the CYBER 74 computer and only INTERCOM commands (5) may be entered except for the CONTROL/T command. The DOSCYB program ignores all inputs until a CONTROL/T is received, which will put the system back into the DATA mode.

**********NOTE**********
*CONTROL/T cannot be entered during a CYBER program CY *
*command execution. *
**********NOTE**********

CONTROL/C used to terminate program execution. (Same as CONTROL/C in DOS (4:4)).

CONTROL/T and CONTROL/C can also be entered when in the direct mode.

3.2 BASIC Commands. All of the commands described in the North Star BASIC manual are valid commands in the CYBERSCP system. For a description of these commands see the BASIC reference manual (4). The DOSCYB executive software uses interrupt driven software to keep system time. This is done by using the TIME program in conjunction with the Vector Interrupt/RTC card (see 1.3) to cause interrupts to

occur at regular frequent intervals. These frequent interrupts must not interfere with diskette read/write operations or a hard disk error will occur. The DOSCYB program automatically disables the Altair interrupt system whenever a DOSCYB command is executed. However, when the BASIC disk read/write commands are executed, the DOSCYB system does not disable the interrupt system. Therefore, the user must disable the interrupt system prior to executing any of the following BASIC disk input/output commands:

OPEN

READ

WRITE

CLOSE

**********NOTE**********
The interrupt system is automatically disabled and re-
enabled for the BASIC SAVE and LOAD commands.
**********NOTE**********

The user must also reenable the interrupt system after the BASIC disk command. Failure to reenable the interrupt system will prevent the DOSCYB system time routine, TIME, from executing.

**********WARNING**********
Failure to disable the interrupt system prior to a disk
read/write command may cause a non-recoverable hard disk
error to occur.
**********WARNING**********

To allow the user to conveniently disable and enable the Altair interrupt system, two special machine language subroutines

are stored in PROM and can be accessed using the BASIC language CALL( ) statement (4:13). The statements are described in Table 3.2-1.

3.2.1 Machine Language Subroutines. To enable the user to take full advantage of the features of the CYBERSCP system, several specialized machine language subroutines have been added to DOSCYB. These subroutines can be accessed in a BASIC source program by using the BASIC statement CALL(X), where X is the decimal address of the subroutine. The calling sequence and a discussion of each subroutine are listed in Table 3.2-1. An example of the use of these subroutines can be found in the CYBER program listing (Appendix 3-2).

3.2.2 Data Base Manipulation. In addition to being able to call machine language subroutines during a BASIC program execution, the user can also dynamically control the common data base parameters initialized by DOSCYB. These data base parameters are described in Section 6. To obtain the value of a parameter, use the BASIC EXAM statement (4:13). To change a data base value use the FILL statement (4:13). See Section 6 for a description of the use of each data base item.

**********CAUTION**********
Careful use of the FILL command is advised since incor-
rectly changing data base parameters may cuase unpredict-
able system operations.
**********CAUTION**********

Table 3.2-1

CALL SEQUENCE*	FUNCTION
CALL (64960)	Scans the diskette directory to determine if the file name stored in FNAME exists on the diskette. If it does then the FPRESF flag is set to one otherwise PFRESF is set to zero. The interrupt system is automatically disabled and re-enabled by this routine, therefore the user does not need to disable the interrupt system.
CALL(65024)	Initializes the Vector Interupt Board interrupt structure and Real Time Clock. Calling this routine will cause the Real Time clock to begin to interrupt at preselected intervals (6:6).
CALL(65094)	Enables the Altair interrupt system.
CALL(65096)	Disables the Altair Interrupt system.
CALL(64613)	Calls the subroutine CYIN (see DOSCYB listing). Puts the Altair in the monitor mode waiting for an input from the CYBER 74 computer.

*All addresses are in decimal.

BASIC Machine Language Subroutines

3.2.3 Input/Output Control. All input and output is controlled by software I/O handlers in DOSCYB. These handlers in conjunction with the 88-2SIO Serial Interface and 88-4PIO Parallel Interface boards process all data between the Altair Computer and its peripheral devices (CRTs, printer, and CYBER 74 computer). The basic I/O handlers provided in North Star DOS allow provisions for modifications to DOS to allow "personalized" I/O conventions (3:9-10). Included in the North Star DOS is the capability for the North Star BASIC to address different devices under software control. This is done by including an optional device code as the first argument in the BASIC PRINT, INPUT, LIST and LINE statements. This device code is restricted to an integer value between 0 and 7 inclusive. When the optional device code is not present, the default code is zero. The device code value is passed to the I/O handlers through the 8080 CPU A register. The I/O handlers then decide how to process the device code.

3.2.3.1 DOSCYB Output Conventions. DOSCYB allows the user to select devices codes 0-7 in the same manner as the North Star BASIC system. Therefore, all BASIC software is limited to selecting only eight devices (0-7) for output operations. Presently, DOSCYB uses only device codes zero through four (5, 6, and 7 are not assigned). The use of 5, 6, or 7 will default to device 0 (see Section 3.0 for a description of these codes). However, DOSCYB has expanded

the device code selection to allow the input from the CYBER 74 computer (Port 19) to be displayed on both the CRT (Port 17) and the printer (Port 35). This is necessary so the operator may obtain hard copy outputs of the data being sent to the Altair from the CYBER 74 computer. Even though the North Star DOS and North Star BASIC restrict the use of device codes between 0 and 7, no restrictions exist if the device code is passed directly to the I/O handlers. Therefore, programs written in assembly code (not using BASIC) may address additional device capabilities. In DOSCYB, the ability to output data to the CRT (Port 17) and the printer (Port 35) simultaneously is implemented by using the three least significant bits (LSBs) to pass the device code to the I/O handlers, therefore, the remaining five bits may be utilized to select additional device capabilities. The command CRT (Port 17) may be selected using any device code with the three LSBs set to zero (XXXXØØØ in the A register). The printer may be selected using device code 3 (00000011) or setting bit position four to one (XXX1XXX). Since only the 3 LSBs can be set using BASIC, the fourth bit can only be set by assembly language coding. Any device code setting both the three LSBs to zero and bit four to one (i.e. 0001000), will select both the CRT (Port 17) and the printer (Port 35) simultaneously. This capability is utilized during execution of the CY command by entering a CONTROL/P.

The CONTROL/P causes bit four of the A register to be set to one. None of the other bits in the A register are changed, therefore the output will continue at the previously selected device in addition to the printer. (The previously selected device must be the CRT attached to Port 17). The output device handlers are programmed in PROM (see Section 1.4) and therefore cannot be readily changed. However, device codes 5, 6, and 7 have not been coded in DOSCYB. To allow user flexibility and programming ease, the PROM output handlers return to the area of RAM reserved for the North Star DOS I/O handlers prior to returning to the DOSCYB calling routine. This feature, allows the user to add additional I/O handlers for devices 5, 6, and 7 in this area of RAM. The only requirements when modifying this area is that the device handler must (1) POP the A register and (2) return the data (output to the device) to DOSCYB in the A register. In addition, the device handler must terminate with a RET instruction (see page 9 of the North Star DOS manual (3) for details on personalizing DOS).

3.3 CYBER Program Commands. The CYBER program is written in BASIC source code. Its primary purpose is to provide a user interface to the CYBER 74 computer. It provides the user with file manipulation, file maintenance, system time control and CYBER 74 INTERCOM command capabilities. These capabilities are provided to the user via the commands

listed in Table 3.3-1. These commands are interpreted and executed by the CYBER program. Illegal commands and commands that are syntactically incorrect are rejected by the program and flagged to the user as errors.

The CY command causes the CYBERSCP system to enter a monitor state during which the output from the CYBER 74 computer is constantly monitored. Since the DOSCYB software is in a loop monitoring the CYBER 74 computer, special immediate control commands are required to maintain control of the CYBER program execution. These specal commands allow the user to maintain data display control and allow the user to terminate the CY command manually. In the default (initialization) mode, the CY command will not display the CYBER 74 transmitted data received by the Altair. The operator can cause the data being received by the Altair to be displayed on either the CRT (Port 16) and/or the line printer (Port 34) by using the CONTROL/Q or CONTROL P commands respectively. The CONTROL/S Command will terminate the display on both devices (the data will still be received but not displayed). The CONTROL/Q command has precedence over the CONTROL/P command. If a CONTROL/Q command is requested after a CONTROL/P then the printer output will stop and the ouput will continue on the CRT. However, if a CONTROL/P is requested after a CONTROL/Q then the output will be displayed on both devices. A CONTROL/D command terminates the CY command immediately. Data reception is

stopped, an abort message is displayed, and control is returned to the CYBER program.

**********NOTE**********
*In subsequent CY commands, the most recent output devices request will continue to be valid. The default mode (no display) is only entered when DOSCYB is initialized.
**********NOTE**********

The TI command is used to display or set system time parameters. If only the command word, TI, is entered then the system time-of-day will be output. To set the system time-of-day, enter the command TI, <hrs>, <mins>, <secs> . The operator should press the "RETURN" key one second before the desired system to allow for the TI command to be processed. System time is not necessarily accurate. The time is derived from the Altair 8800b 2MHz internal clock and is divided down to 10 ms intervals. These intervals are counted by the TIME program to maintain system time. The TIME program keeps system time by accumulating 10 ms time increments each time it is interrupted. However, when the intercept system is disabled because of a disk I/O access, multiple counts may be skipped by the TIME program. Because of these skips, the system time may not remain accurate with the actual time-of-day. If the DUR parameter is included in the TI command then the TISET data base parameter is set to the input parameters in the command. In this case system time is not set. The TISET parameter is the event duration count for DOSCYB. It is used in conjunction with the data base parameters TICNT and TIFLG.

Table 3.3-1

Command	Description
TI[,<hrs>,<mins>, <secs>[,DUR]]	Without the optional parameters returns the system time in hrs:mins:secs format. When <hrs>, <mins>, <secs> parameters are present, sets system time. DUR parameter causes data base item TISET to be set to <hrs>, <mins>, <secs>.
CY	Puts the CYBERSCP system into the monitor state waiting for a CYBER 74 data transmission.
LC,<start>,<stop> [,<device>]	Lists the contents of the input buffer CYFW on the optional <device>. If no <device> is specified then the output is to Port 16 (CRT).
LF,<source>,<stop> [,<device>]	Lists the contents of the diskette file <source> from the beginning to address <stop>, where<stop> is the number of bytes to be listed. The default <device> is Port 16 (CRT).

Table 3.3-1 (Cont'd)

Command	Description
SA,<sources>,<dest> [,ADD]	Saves the CYBER 74 file <source> on the diskette file <dest>. If ADD is present the <source> is added to the end of the <dest>.

**********CAUTION**********

*This command requires that the diskette be unprotected prior to execution. This is done by removing the "write protect" tab from the diskette. Failure to unprotect the diskette will cause a system abort and return to DOSCYB.

*To return to the CYBER program enter: JP 2A04 <CR>
RUN <CR>

**********CAUTION**********

**********WARNING**********

*When using an unprotected diskette, any failure should be thoroughly investigated and resolved before continuing.

*Failure to do so could result in permanent damage to the diskette contents.

**********WARNING**********

TR,<source>,<dest>[,ADD]	Transfers the diskette file <source> to the CYBER 74 computer and saves it as the CYBER 74 local file <dest>. If ADD is present, the <source> file is added to the end of <dest>.

Table 3.3-1 (Cont'd)

Command	Description
BY	Terminates the CYBER program and returns control to BASIC.
CONTROL/Q*	causes data being received from the CYBER 74 (Port 18) to be displayed on the CRT (Port 16).
CONTROL/P*	causes data being received from the CYBER 74 to be displayed on the line printer (Port 34).
CONTROL/S*	Suspends all display data initiated by CONTROL/Q or CONTROL/P.
CONTROL/D*	Terminates the CY command. Control is returned to the CYBER program.

*Command is valid only during a CY command.

When the TI command with the DUR parameter is entered, TICNT is set to zero. TIME increments TICNT during each interrupt. When TICNT is equal to TISET, which was set by the TI command, then the event indicated by the TIFLG is executed and TICNT is reset to zero and the cycle begins again. In the current DOSCYB System, TIFLG can have the values 00(HEX) or 01(HEX) whose function are as follows:

VALUE (HEX)	FUNCTION
00	Default value. No action executed by the system.
01	When the duration set by TI, ···, DUR is reached the message "HELLO" is sent to the CYBER 74 (port 19).

The default value for TISET is Ø hrs, 5 mins, Ø secs.

4.0 LIMITATIONS.

This section presents a summary of the limitation noted previously in this manual. These limitations exist in two general areas: (1) operational restrictions the user should observe and (2) limitations inherent in the system that should be considered if modifications or other detailed analysis is to be performed on the system.

4.1 Operational Limitations. The limitations described in this section directly affect user control of the DOSCYB. These limitations, listed below, must be observed to ensure proper operation of the system:

1. Only the device codes listed in Section 3.Q may be used with the following BASIC input and output commands:

LIST

PRINT

INPUT

LINE

If a device code is used that is not listed in Section 3, the default device will be assumed (default is device zero).

2. If system output is directed to the printer (i.e. device code three or executing CONTROL/P) and the printer is not connected and ON then the CYBERSCP will "hang" until the printer is ON.

3. When using the TR or SA commands the CYBER 74 data link must be initialized (see Section 2.2.5 for initialization procedures).

4. When executing the TR, <source>, <dest>, ADD command the <dest> file must previously exist as a local file in the CYBER 74 system. If it does then the CYBERSCP will abort. If the optional ADD parameter is not used the <dest> must not exist as an attached file in the CYBER 74 system.

5. When using the SA, <source>, <dest> command the <source> file must previously exist as an attached local file in the CYBER System. CYBERSCP will abort if it is not present.

4.2 System Limitations. The limitations described in this section are limitations imposed on the CYBERSCP system. These limitations are normally transparent to the system user, however they can affect system performance and therefore the user must be aware of them. In addition, if any system modification are attempted (software, hardware or data base) then these limitations listed below must be observed:

1. After the CYBER program has been executed once, the interrupt system is enabled, therefore, the interrupt system must be disable using the CALL(65096) command prior to executing any diskette read or write commands. (See Section 3.2). Failure to disable the interrupt system prior to writing on the diskette may cause a non-recoverable hard disk error. In addition, the diskette contents may be permanently altered.

2. System time is not accurate with the actual time of day (even after being set) due to the disabling of the interrupt system during diskette read and write operations. (See Section 3.3 for a description of the TI command).

3. The CYBERSCP system currently allows only the values 00(HEX) and 01(HEX) for the TIFLG parameter (see Section 3.3 TI command description). If any other value is used the system will ignore the value (same action as TIFLG=00).

4. The bit rate used for the interface between the Altair computer and the command console (port 17) must be

higher than the bit rate to the CYBER 74 (port 19). If it is not then data will be lost between the CYBER 74 and the Altair. The current interface rates are 9600 bps for port 17 and 300 bps for port 19.

5. The CYBERSCP system common data file, DATA, is resident on the minifloppy diskette in a file called DATA. Its location is disk sector 14. This location must not be changed since the system initialization routine INITT assumes the file is in location 14. If the location is changed (by a CO command) the INITT routine must be changed to reflect the new location.

5.0 SYSTEM MESSAGES

All of the messages normally output by the North Star DOS and BASIC programs (3) (4) are also output by DOSCYB and BASIC in the CYBERSCP system. In addition, other messages are output by DOSCYB and the CYBER program as a result of commands to the system. These messages consists of normal system messages, listed in Table 5-1 and error messages, listed in Table 5-2. These tables include the message content, the software routine generating the message (in the case of the CYBER program, the subroutine), and the command(s) causing the message. The error messages include possible causes for the message. Appendix 3-1 contains examples of all of the system messages.

6.0 DATA BASE INITIALIZATION

The data base parameters utilized in the CYBER System

Table 5-1

MESSAGE	SOURCE PROGRAM/SUBROUTINE CYBER/MAIN	SOURCE COMMAND
REQUEST-		N/A
TIME:<hrs>:<min>:<sec>	CYBER/TI	TI
ABORT CYIN	DOSCYB/CONTG	CONTROL/D
DATA MODE	DOSCYB/TELE1	CONTROL/T
TELE MODE	DOSCYB/CONTG	CONTROL/T
CYBER MESSAGE RECEIVED. <hrs>:<min>:<sec>	CYBER/CY	CY
END OF PROGRAM: <hrs>:<min>:<sec>	CYBER/MAIN	BY

CYBERSCP Normal Messages

Table 5-2

Error Message	Cause	Command
ILLEGAL REQUEST-(com)*	Invalid or misspelled request entered	All
ARGUMENT ERROR-(arg)	Invalid arument entered after valid command keyword	All except CY
ARGUMENT OUT OF CFILE-(arg)	Range of <start> or <stop> address is out of the CFILE buffer	LC
NUMERIC ARGUMENT EXPECTED-(arg)	A number was expected in the argument	LC, TI
<SOURCE> DOES NOT EXIST - (source)	File <source> could not be found	TR, SA, LF
EMBEDDED BLANK IN ARG-(arg)	A blank was found in the <source> or <dest> name	TR, SA, LF
MISSING ARGUMENT-(com)	A required argument parameter was missing	(All except CY)
<DEST> DOES NOT EXIST-(dest)	File <dest> could not be found	TR, SA, LF
<DEST> FILE FULL - (dest)	<dest> file on the diskette is full	SA
BUFFER FULL-(number) BYTES	The input buffer CFILE is full	CY

*( ) indicate variable output conditions

CYBERSCP System Error Messages

are located in the file "DATA" on the mini-floppy diskette. During the initialization process, this file is automatically loaded into RAM starting at address 000_8 by DOSCYB. Locations 000_8-077_8 are reserved for interrupt service routine linkage, therefore the data parameters are stored starting at location 100_8. The initial value of each data base parameter is described in Table 6.1. Initialization occurs only when DOSCYB is bootstrapped following the procedures in 2.2.1. Once loaded, these parameters are changed (set/used) as required.

Table 6.1

Address (Octal)	Content (Octal)	MNUEMONIC
100	000	MODE
101	015	CR
102	000	EOT
103	012	CRG
104	000	EDIT
105	012,"COMMAND" 055,240	COM
117	000	I
120	012,056,240	EDT
124	000	CYCCR
126	000,001	CYFW
130	000,020	CYCNTI
132	000,020	CYCNT
134	000	CYFULL
135	000	FNAME
146	000	FPRESF
147	000	NMB
154	000	CURLEY
155	012,015,"TELE MODE" 007,000,015,012,000	TMSG
214	012,015,"ABORT CYN", 007,015,012,000	ABMSG
235	001	PRNTTY
236	001	PRNTF

DATA BASE Initial Parameters (1 of 2)

Table 6.1 (Cont'd)

ADDRESS (Octal)	CONTENT (Octal)	MNUEMONIC
237	000105	TACOM
241	000120	TAEDT
243	000	TICNT
247	000,000, 005,000	TISET
253	001	TIFLG
254	303,024400	TITRP1
257	000,000000	TITRP2
262	000,000000	TITRP3
265	000,000000	TITRP4
270	000,000000	TITRP5
273	000,000000	TITRP6
276	000,000000	TITRP7
301	000,000000	TITRP8
304	000	INMASK

DATA BASE Initial Parameters (2 of 2)

Bibliography

1. MITS. Altair 8800b Documentation. Reference manual. Albuquerque, New Mexico: MITS, April 1977.

2. Shugart Associates. SA400 Minifloppy Diskette Storage Drive. OEM Manual. Sunnyvale, California: Shugart Associates, 1977.

3. North Star Disk Operating System, Version 2. DOS manual. North Star Computers, Inc., 1977.

4. North Star BASIC, Version 6, Version 6-FPB. BASIC reference manual. North Star Computers, Inc., 1977.

5. INTERCOM VERSION 4 Reference Manual. St. Paul, Minnesota: Control Data Corporation, Publications and Graphics Division, 1977.

6. MITS. Vector Interrupt/Real Time Clock. 88-VI and RTC Manual. Albuquerque, New Mexico: MITS, February 1976.

7. Ravenscroft, Donald L. "Electrical Engineering Digital Design Laboratory Communication Network," Part 2. Master's thesis. Air Force Insititute of Technology, WPAFB, Ohio, 1978.